therefore recommend Mr. Palmer's book with confidence to those teachers who take a special interest in and make a special study of the teaching of arithmetic. They will probably find rules and methods which they do not approve of, but these can be neglected without any loss. The method of dealing with the multiplication of decimals is open to the objection that without any gain a much more difficult method than the direct one is given. The author makes use of rough approximations before and rough checks after working out an example. These are very good, and should be used in all working, but they should not be made the means of finding the decimal point in approximations. The placing of the point should give no difficulty if a logical method has been adopted throughout the study of decimals.

(3) Mr. Jones's book is a laudable attempt to remove the study of arithmetic from its commercial trammels and widen its scope. We are afraid that, in the attempt, he has overburdened his book. Practical work is introduced at all stages of the work, and the numerous explanatory diagrams will be a useful addition to the teaching of the subject. There are one or two things which strike us as being out of place in a book which is intended for a general course in arithmetic. Thus the tables of weights and measures include some units which are not in general use. The introduction of these tends to specialise the work, a thing which Mr. Jones claims, in his preface, that he desires to avoid. We are sorry to see in an arithmetic of this type the instruction to "move the point." It is always difficult for a teacher to keep before young pupils the reason for the step, and he is not aided when the text-book adopts the mechanical method. Mr. Jones has added an index, an example that ought to be followed by all writers of school text-books.

F. L. G.

OUR BOOK SHELF.

Die typischen Geometrien und das Unendliche. By B. Petronievics. Pp. viii+88. (Heidelberg: C. Winter, 1907.) Price 3 marks.

THE author of this curious work asserts (p. 86) that it is impossible to make a one-one correspondence between the points of a linear segment and the elements of the arithmetical continuum (0, 1); in other words, he not only declines to accept the Dedekind-Cantor axiom, but asserts that it is illogical. His attempted proof (p. 85) involves the assumption of actual infinitesimal segments; thus he says "so entspricht dem ersten Punkte, der sich mit dem o-Punkte berührt, gar keine Zahl in der Zahlmenge o . . . 1, da das entsprechende Segment unendlich klein ist, und dasselbe wird auch für den zweiten, dritten usw. Punkt gelten."

This idea of immediately adjacent yet different points pervades the whole tract, and leads to wonderful paradoxes; an attempt is made to remove the most obvious difficulties by a distinction between real and unreal points (pp. 9, 10), but this is not satisfactory. There is a continual confusion between the idea of space consisting of points and that of points forming "parts" of space. You cannot eat your cake and then look at it; if in one context "point" means something with extension, it should not be treated elsewhere as having position only. Moreover, no intuition, logic, or metaphysic can get a geometrical thing having extension from two points devoid of it.

Unless something better than this can be said for it, the assumption of actual infinitesimals of different orders in geometry is not likely to be accepted, and the Dedekind-Cantor axiom will probably be retained as the simplest way of connecting geometry with analysis. From the metaphysical side we want something better than a puerile criticism of Cantor's transfinite number-system, vitiated by misunderstandings. Extensional quantities (lengths, volumes, &c.) can be arithmetically defined for figures in an arithmetical space; but no one with an active geometrical imagination can enjoy this way of treating the subject, although he may admire it as a logical feat. Again, take the connectivity of Riemann surfaces, or the classification of knots; here are things with characteristics easily recognised by inspection, but difficult to specify by the arithmetical method; cannot we find some means for testing our intuitions without putting them into this newly invented arithmetical machine? To give a satisfactory answer to the questions arising from the modern aspects of mathematics is a task sufficient to strain the highest philosophical powers; and although Dr. Petronievics has the temerity to declare that Hilbert's "Grundlagen der Geometrie" is logically defective (p. 24, end), he has added little, if anything, which is of value or interest to the discussion.

G. B. M.

Engineering Workshop Practice. By Charles C. Allen. Pp. vii+254. (London: Methuen and Co., n.d.) Price 3*s.* 6*d.*

A BOOK for students on engineering workshop practice is, in many ways, more difficult to write than one addressed to those who, from years of actual practice, have gained an intimate knowledge of the elaborate processes by which engines and other machines are produced. The beginner requires ample explanations of processes, which he has probably never seen carried out, but which to the workman are as familiar as his daily paper.

This book, good as it is, would have been much more useful if no attempt had been made to write for the information of both the beginner and the skilled workman; their needs are so different that the result cannot be satisfactory to either class. A typical instance of the consequences of such an attempt occurs on p. 159, with reference to the cutting of vee threads in a lathe. In a short paragraph the author points out, quite properly, that, in taking a cut over the whole form, there is a great tendency to rip the thread, and then goes on to state that the diagrams indicate the proper method, but offers no further explanation of them. To a skilled workman these diagrams are quite unnecessary; to a student they are merely perplexing. He is left to discover, if he can, that one diagram is intended to indicate that the roughing cut is to be taken on one side of the vee, while in a second diagram a tool, apparently floating in mid-air, lies between two objects, which he may or may not recognise as rake gauges. In other cases where explanations of the diagrams are given they are far from being clear; thus on p. 191, in the instructions for cutting helical gears, we are told that "The cutter used must be selected for the number of teeth there would be in a gear with outside diameter equal to the diameter of a circle determined by the curvature of the gauge in this way." But the author gives no intelligible explanation of what "this way" is.

While it is proper to direct attention to blemishes

of this kind, there is no doubt that the author has produced a book of considerable merit, the value of which would be considerably enhanced in future editions if the attempt to deal with the wants of the skilled workman were frankly abandoned.

The text covers most of the elementary operations of the fitting and machine shops, and the graduated exercises are well thought out, and in a well-equipped college workshop under the supervision of a skilled instructor a beginner would no doubt make remarkable progress in the use of tools, and be of real value in a works at the end of the course of instruction.

Steam and other Engines. By J. Duncan. Pp. ix+471. (London: Macmillan and Co., Ltd., 1907.) Price 5*s*.

THE development of municipal technical schools during the last few years has given a great impetus to the production of books written especially for elementary students. Mr. Duncan's book, on steam and other engines, is an admirable little work of this class, which students in the early part of a course on mechanical engineering will greatly appreciate, for it is well and clearly written, and covers a wide range of modern practice.

There is nothing more attractive to young engineering students than the purely mechanical details of engines, and the wealth of illustrations accompanying the descriptive matter will no doubt prove of great interest.

While the illustrations are a prominent feature of this book, the more important elementary principles of heat-engine theory and applied mechanics are also presented in a very skilful manner. Students working through the course of instruction prescribed, especially if they are able to carry out the experiments and take part in the engine and boiler trials, as the author recommends, will obtain quite a considerable knowledge of steam and other heat engines.

There appear to be very few errors or mistakes of any importance, but occasionally the author is not an accurate guide, as, for instance, when dealing with the flow of steam in an expanding nozzle he incidentally says that "In the case of a liquid the problem is simple as the property of expansibility is absent," a statement in direct contradiction to the actual facts, as students of hydraulics are well aware.

The Elements of Mechanics. A Text-Book for Colleges and Technical Schools. By W. S. Franklin and B. Macnutt. Pp. xi+283. (New York: The Macmillan Co.; London. Macmillan and Co., Ltd., 1907.) Price 6*s*. 6*d*. net.

A BOOK on elementary mechanics, which commences by addressing the reader as my young friend, and immediately after, in a lengthy paragraph, draws a comparison between the student and the axolotl, does not seem very promising as a scientific work. This feeling is strengthened when a little further on, in speaking of the laws of motion, one of the authors writes:—

"You, my young friend, must have in some measure my own youthful view, which, to tell the truth, I have never wholly lost, that there is something absurd in the idea of reducing the more complicated phenomena of nature to any orderly system of mechanical law. For to speak of motion is no doubt to call to your mind first of all the phenomena that are associated with the excessively complicated, incessantly changing, turbulent and tumbling motion of wind and water. These phenomena have always had the most insistent appeal to us; they have confronted us everywhere and always, and life is an unending contest with their fortuitous diversity, which rises only too often to irresistible sweeps of destruction in fire and flood, and in calamitous crash of collision and collapse where all things commingle in one dread fluid confusion."

The book does not, happily, continue in this style after the opening chapter, but commences a systematic treatment of elementary mechanics on familiar lines, which, however, does not present any new features worthy of notice, except that inaccuracies and lack of precision in the statement of scientific principles are numerous. A new text-book on mechanics may be justifiable, if the authors can present the subject in a better way than has been presented before, or in a form more adapted to the wants of its readers, but a comparison of this work with any good elementary treatise on the subject cannot fail to show its inferior character. E. G. C.

Die Lösung des Problems der Urzeugung (Archigonia, Generatio spontanea). By Martin Kuckuck. Pp. vii+83; with 34 figs. and one table. (Leipzig: Barth, 1907.) Price 3 marks.

DR. KUCKUCK made a mixture of gelatine, peptone, asparagin, glycerine, and sea-water, boiled it for an hour, put it in a sterilised vessel, and added a little chloride of barium, which brought about ionisation. The outcome was the formation of minute bodies like protozoa, which show "nutrition, growth, reproduction (segmentation), inheritance, movement (rotation), and form cell-groups (cœnobia of Haeckel), which resemble animal morulæ." Barium chloride produces similar morulæ in fresh white of egg and in yolk of egg. Drops of natrium nucleinecum (Merck), allowed to fall on the surface of the gelatine-peptone-asparagin-glycerine-sea-salt mixture, produce rotating corpuscles, which form loose colonies. The author gives very interesting and striking figures, some drawn, some from photographs, of his artificial cells and cell-colonies. The figures drawn from the artificial morulæ would pass muster in a text-book of embryology; the cell-outlines are sharply defined, and each cell has a beautiful nucleus. It seems to us that these and similar experiments would be more interesting, if less were proved.

On this experimental basis, Dr. Kuckuck rears a theoretical superstructure. Mixtures of inorganic and organic substances pass by ionisation into protoplasm. Salts of barium, radium, and nuclein effect this ionisation. The process of organisation is a process of ionisation. It is so now, and it was so in the beginning. The first organisms arose in the sea and were non-nucleated Monera. The nucleated cell arose by the symbiosis of two aniso-electrical non-nucleated cytodes, as is proved by the fertilisation-process, for is not ontogeny a recapitulation of phylogeny? "Everything living has sex (negative and positive ions), and everything is living because it has sex (negative and positive ions): ohne Geschlecht kein Leben." A sort of genealogical tree is given showing the origin of organisms from inorganic substances, so that the Stammbaum is now quite complete, even as to its roots. J. A. T.

The Flora of Columbia, Missouri, and Vicinity. By F. P. Daniels. The University of Missouri Studies. Science Series, vol. i., No. 2. Pp. x+319. (The University of Missouri, 1907.)

As a study of a local flora, this memoir, furnishing a list of the plants and an ecological survey, forms a suitable volume for the science series of the Missouri University publications.

The flora is characterised by a predominance of genera belonging to the orders Compositæ, Gramineæ, and Leguminosæ. The sedges are numerous, since the species of Carex exceed fifty. Desmodium, Mes-